

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: Higgins

Serial No.: 10/797,272

Filed: March 10, 2004

Confirmation No.: 2948

For: **METHOD FOR IN-FURNACE REDUCTION
AND CONTROL OF SULFUR TRIOXIDE**

Examiner: K. Rinehart

Art Unit: 3749

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

**DECLARATION UNDER 37 CFR §1.132
OF MARK SHILLING**

I, Mark Shilling, declare that:

1. I have been granted the degree of Bachelor of Science in Mechanical Engineering from Grove City College.
2. I have 30 years of experience in the field of Power Generation, Power Plant Maintenance and Operations, Power Plant Performance Testing, Power Plant Combustion Control and Pollution Reduction.
3. I have authored or co-authored 2 publications and presentations in the field of NO_x Reduction and am the inventor or co-inventor of 1 patent in the field of Combustion.
4. I am currently employed by Nalco Mobotec. In this position, my title is Manager, Field Services and Tuning.
5. My major accomplishments in the field of Power Generation, combustion control and pollution control are related to the implementation of new technologies for NO_x reductions.

6. I have known the inventor, Dr. Brian Higgins professionally for 5 years and we are currently employed by the same company, who is also the assignee of the aforementioned patent application.
7. I have reviewed the specification and claims as filed on March 10, 2004, and the USPTO's response dated June 18, 2007.
8. I have paid particularly close attention to the Examiner's rejection of claims 1-24 under 35 USC §112, first paragraph.
9. It is my understanding that my opinion is sought as to whether or not on March 10, 2004 I would have known how to perform the invention according to the aforementioned specifications and claims, based on those specification and claims and my knowledge of what known in the field at that time.
10. My opinion is that I would have known how to perform the invention according to the aforementioned specifications and claims, based on those specification and claims and my knowledge of what known in the field at that time.
11. I am also of the opinion that undue experimentation would not have been necessary to perform the invention at that time.
12. In my opinion a worker less skilled in the art than myself would also be able to perform the invention without undue experimentation, based on the same specifications and claims and what was known in the field on March 10, 2004.

13. My opinion that I would have known how to perform the inventions of claims 1¹, 9² and 17³ is based on the following facts:

A. The application discloses optimum SO₃ levels at 15 to 20 parts per million (ppm) in flue gas.⁴ Thus, I would have known to reduce the SO₃ levels until I had reached an endpoint in the range of 15 to 20 ppm. I would have known when I reached this level by quantification methods well known in the art.

B. With respect to how I would have reduced the SO₃ levels to the desired level, I would have considered one of the seven methods of increasing the residence time, or one of the four methods of increasing the reducing potential in the flue gas, as set forth in the specification.⁵

C. I would have been aware of the eleven potential methods and been familiar with how they could effectuate the desired change. For example, increasing the temperature decreases the density of the air and results in a reducing atmosphere. Decreasing the stoichiometric ratio will reduce the generation of SO₃ through enhancing the reducing atmosphere in the burner zone. Increasing the local fuel flow will result in enhancing the reducing atmosphere for SO₃ reduction. Decreasing the local air flow will alter the fuel/air ratio resulting in more of a reducing atmosphere. This was generally known in the art.

D. I also would have known how to perform the eleven methods. I would have known that the distance between stages could be lengthened by utilizing ports higher in the furnace. I would have known that the mixing could be increased for macro-staging applications

¹ "...adjusting the reducing environment such that SO₃ is reduced to SO₂ prior to selective catalytic reduction to achieve a desirable level of SO₃ for optimizing precipitator function..."

² "...adjusting the reducing environment such that SO₃ is reduced to achieve a desirable level of SO₃ for optimizing precipitator function..."

³ "...adjusting the reducing environment time period such that SO₃ is preferentially reduced to SO₂ to achieve a desirable level of SO₃ for optimizing precipitator function..."

⁴ Page 2, lines 15-18.

⁵ Page 9, lines 13-17.

by altering the OFA air port locations, pressures, flows, ports sizes, or burner zone air. I would have known that the mixing could be decreased for micro-staging applications by altering the burner settings, burner openings or changing the burner tips. I would have known that the mass flow between stages could be reduced by reducing the air entering the burner zone, reducing the fuel entering the burner zone, and/or enhancing the combustion to allow lower mass flows. I would have known the volumetric utilization between stages could be increased by altering the OFA air port locations, pressures and flows. I would have known that temperature could be increased by altering the swirl in the burner zone through the use of burner controls. I would have known that the stoichiometric ratio could be decreased by altering the fuel/air ratio. I would have known that the local fuel flow could be increased by increasing the coal flow through the pulverizers, increasing the fuel flow through oil or gas burners, and/or increasing the amount of fuel on a grate. I would have known that the local air flow could be decreased by changing the air controls on the boiler to increase the air flow through the burners. These methods were generally known in the art.

E. I would have known that the most suitable method of reducing the atmosphere in the combustion zone of the furnace was very furnace-specific because furnaces vary widely with respect to many crucial elements including availability of boiler controls, burner tools for altering flame shape, pulverizer controls, air flow controls.

F. In spite of the absence of a one-size-fits-all method of reducing the atmosphere in the combustion zone of the furnace, I would have known that the certain characteristics of a given burner would better lend themselves to certain methods. For example, if a burner were installed on an operating unit I would not employ the method of replacing the burner tip because an outage would be required to perform the work, but the method of altering the burner settings would be suitable. I would not change the distance between stages if additional ports had to be added to the unit if decreasing the stoichiometric ratio works. Increasing fuel flow to reduce the stoichiometric ratio would be preferable over altering the OFA placement, or changing the OFA settings such that other pollutants would increase. This would be known by others in the art.

G. If the chosen method or methods did not yield the desired SO3 level I would have known to try another method or adjust the chosen method until the desired results were achieved.

H. Trying an alternate method or adjusting the chosen method, in my opinion, would not have constituted undue experimentation because a certain amount of trial and error would be expected in light of the variability between boilers, as mentioned above.

I. Taken together, I would have been able to adjust the SO3 to a desirable level to optimize the precipitator function as set forth in the claims. I would have been able to do this without undue experimentation.

14. By signing my name below I declare that all statements made in this document of my own knowledge are true, and all statements made on information and belief are believed to be true. I further declare that these statements are made with the knowledge that willful false statements are punishable by fine or imprisonment, or both, under Section 1001, Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing on the application.

Respectfully Submitted,

Mark Shilling

Mark Shilling

1-11-08

Date